REMARKS

In the foregoing amendments, claim 12 was canceled, claims 37 and 40 were amended, and claim 86 was added. In particular, claim 37 was amended to recite that the enzyme is isolated (see the examples for isolation of enzymes) from a fungus that belongs to *Zygomycotina* (described in original claims 3, 22 and 36, for example). Claim 40 was amended to better clarify the phrase "modified protein." In particular, the modified protein exhibiting endoglucanase activity and having a modification such as an addition, insertion, deletion or substitution of one or several amino acids. Support for this amendment can be found on, for example, page 25, line 2, and page 16, third paragraph, of applicant's specification disclosure. New claim 86 is limited to SEQ ID NOs 1, 3, 5, 7, 9 or 11, which were set forth in original claim 40. Withdrawn claim 12 was canceled, so that the total number of claims in the application remains the same.

Claims 1-11, 13-56, and 58-86 are pending in the application. Claims 1-11, 13-36, 41-56, 58, and 59 were withdrawn from consideration. Accordingly, claims 37-40 and 60-86 are in the application for consideration by the examiner at this time.

Claims 37-38 were rejected under 35 U.S.C. § 112, second paragraph, on page 3 of the Official action, because the metes and bounds of the phrase "derived from a filamentous fungus" were not clear. In the presently amended claims, the phrase "derived from a filamentous fungus" was amended to "isolated from a filamentous fungus that belongs to *Zygomycotina*" in order to better clarify the invention. Applicant respectfully submit that claims 37 and 38 particularly point out and distinctly claim the subject matter regarded as the invention within the meaning of 35 U.S.C. § 112, second paragraph. Therefore, applicant respectfully requests that the examiner reconsider and withdraw this rejection.

Claims 37-40 and 60-85 were rejected under 35 U.S.C. § 112, first paragraph beginning on page 4 of the Official action. In particular, the Official action stated that the specification is enabling for an endoglucanase enzyme with specific disclosed SEQ ID NOs but not enabling for modified endoglucanases or homologues of said endoglucanases or endoglucanases having a CBD as claimed in claim 38. The Official action also stated that there is no written description in the specification of modified/homologue polypeptide and polynucleotide sequences encompassed by the claim.

Applicant respectfully disagrees for the following reasons. Firstly, the specification starting at page 16, lists several types of "modifications" of the presently claims enzymes. The claimed enzymes must retain endoglucanase

activity and the specification describes how to assay enzyme activity. The specification lists that the protein may be modified so that aspargine (Asn)-linked oligosaccharide chains are not added thereto, or that the linker region may be modified. Further, the art set forth in the outstanding Office action, indicates that "modification" of enzymes containing a particular consensus sequence is within the scope of the art. Claim 9 of Schulein '690 teaches a CBD of a 43kD endoglucanase from *H. insolens* with a catalytic core from a different enzyme. Further combinations of the novel CBD of the present invention with a catalytic domain and linker region are well described in the specification. For example, see page 17 beginning with the second paragraph. The specification contains an enabling written description of modifications of the disclosed sequences. See, for example, applicant's specification beginning at page 25 line 2, example B10 on page 48 and example D3. The present specification envisions sequence variations of the disclosed SEQ ID NOs and describes how to obtain them (the optimized enzymes of the examples).

Finally, applicant strongly disagrees with the argument that endoglucanases with a CBD as shown in claim 38 are not supported by the specification. The specification discloses the identification of six different enzymes each containing the consensus sequence shown in claim 38. Further this consensus sequence has not been previously described. The consensus sequence was found in a minimum of three different species and in a novel

location, the N-terminal region of each protein. The specification describes how to obtain homologues of a gene encoding the novel CBD, see example C1 on page 49 of the specification. The consensus sequence and a written description of how to obtain homologues to the sequence and to obtain a similar sequence in a different species are described in detail in the specification of the present application. Therefore, the specification is commensurate in scope with the claimed invention and, therefore, applicant respectfully requests that the examiner reconsider and withdraw the rejection under 35 U.S.C. § 112, first paragraph.

Claims 37-38, 40, and 60-85 were rejected under 35 U.S.C. § 102(b) as being anticipated by WO94/07998 of Schulein (hereinafter Schulein '998). The Official action stated that Schulein '998 discloses an endoglucanase derived from fungi and belonging to family 45 and its use in a variety of processes. The Official action concluded that since no limitation is placed on the number of changes that can be present in the amino acid sequence of SEQ ID NOS: 1, 3, 5, 7, 9, or 11, the sequence disclosed by Schulein anticipates the application as written.

Applicant respectfully disagrees for the following reasons. Firstly, the cellulose binding domain (CBD) of the enzyme proposed in the Schulein '998 reference is located in the C-terminus of the protein (the last line of sequence in Figure 1b of Schulein '998). As described in the specification, the novel

enzymes of the present invention each disclose a CBD in the N-terminus. The table on page 17 of applicant's specification describes 6 independent sequences each with a CBD within the first 89 amino acids. In the sequences proposed in Schulein '998, the CBD is located in the 250-282 amino acid range (see figure 1b of Schulein '998). Therefore, the enzyme proposed by Schulein '998 cannot be said to encompass an endoglucanase in the N-terminus as is claimed in present claims 37 and 39. Secondly, the CBD of the enzymes propose by Schulein '998 (43kdfus and 43kdhum from figure 1) do not disclose a CBD with the consensus sequence SEQ ID NO:18 as claimed in claim 38. As shown below, the CBD of the enzymes proposed by the Schulein '998 reference are dissimilar from CBD consensus of the presently claimed invention.

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                1   2   3   4   5   6   7   8   9   10  11  12  13  14  15
(SEQ ID NO:18)  Xaa-Xaa-Xaa-Xaa-Xaa-Xaa-Gln-Cys-Gly-Gly-Xaa-Xaa-Xaa-Xaa-Gly-
43kdfus         Val-Val-Pro-Ala-Tyr-Tyr-Gln-Cys-Gly-Gly-Ser-Lys-Ser-Ala-Tyr-
43kdhum         Thr-Ala-Glu-Arg-Trp-Ala-Gln-Cys-Gly-Gly-Asn-        Gly-Trp-

                16  17  18  19  20  21  22  23  24  25  26  27  28  29
(SEQ ID NO:18)  Xaa-Xaa-Xaa-Cys-Xaa-Xaa-Xaa-Xaa-Xaa-Xaa-Cys-Xaa-Xaa-Xaa-
43kdfus         Pro-Asn-Gly-Leu-Ala-Cys-Ala-Thr-Gly-Ser-Lys-Cys-Val-Lys
43kdhum         Ser-Gly-Cys-Thr-Thr-Cys-Val-Ala-Gly-Ser-Thr-Cys-Thr-Lys-

                30  31  32  33  34  35  36  37  38  39
(SEQ ID NO:18)  Xaa-Xaa-Asn-Xaa-Xaa-Tyr-Xaa-Gln-Cys-Xaa  (SEQ ID NO: 18)
43kdfus         Gln-Asn-Glu-Tyr-Tyr-Ser-Gln-Cys-Val-Pro-Asn
43kdhum         Ile-Asn-Asp-Trp-Tyr-His-Gln-Cys-Leu
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It is noted that within SEQ ID NO:18, Xaa is independently any amino acid residue; Xaa's at positions 20, 21, 22, 23, 24, 30 and 31 may be independently absent; and one of Xaa at position 11 or 33 is Lys and the other is any amino acid residue except Lys. It can be seen that neither CBD of the Schuelin '998 enzymes contains a Lys at position 11 nor 33 (with accounting for the amino acid variation in SEQ ID NO:18 at positions 20, 21, 22, 23, 24, 30 and 31). Further, the sequence of the 43kD from fusarium proposed by Schulein '998 cannot meet the Gly-Xaa-Xaa-Xaa-Cys (amino acids 15-19 of

SEQ ID NO:18. Finally, Schulein '998 does not disclose or suggest the enzymes comprising the claimed SEQ ID NOs: 1, 3, 5, 7, 9, or 11 nor polynucleotides therefore. For all of these reasons, applicant respectfully submits that the Schulein '998 reference cannot anticipate the claims as amended nor new present claim 86.

Claims 37-40 and 72-73 were rejected under 35 U.S.C.§ 102(b) as being anticipated by U.S. patent No. 4,966,850 of Yu *et al.* (hereinafter Yu). The Official action stated Yu discloses an endoglucanase composition isolated from *Mucor* sp. and pointed to col. 14 and tables 9-11 to support this argument. The Official action admitted Yu does not disclose that the endoglucanase belongs to family 45 or that it has an N-terminal CBD, but argued that the reference inherently discloses that same enzyme as is claimed and the burden is on the applicant to show a novel or unobvious difference between the claimed produce and the product of the prior art.

Applicant respectfully disagrees for the following reasons. Firstly, Yu does not disclose or suggest an isolated enzyme as is currently claimed. Secondly, the Official action pointed to column 14 as demonstrating an endoglucanase from Mucor sp. However, what is disclosed at columns 13-14 of Yu is an assay for xylanase and cellulase activity. In the first tube clearing assay, the Mucor sp. did not work (col. 13, line 45). In the second assay, the Mucor sp. exhibited low cellulase or xylanase enzyme activity (col. 14, lines 15-

16). Although there is a description of slight cellular activity of the enzymes produced by Mucor in Yu (Fungal strain C416 Mucor sp. of table 11), this cellulase activity includes cellobiohydrolase activity and β-glucosidase activity. In general, cellulases are classified into endoglucanase, cellobiohydrolase, and β-glucosidase. An exoglucanase, cellobiohydrolase decomposes avicel, but endoglucanase does not decompose avicel. Both filter paper and avicel comprise crystalline cellulose, and thus they act similarly as a substrate. Therefore, the activity assay described by Yu does not show endoglucanase activity but low cellulase activity. Finally, the assays of Yu are carried out at neutral pH levels (Figure 3) whereas the enzymes of the present invention retain activity under alkaline conditions. On the face of it, any enzyme activity of the Mucor sp. disclosed by Yu, which is very low, would not be active at alkaline pH levels (see alkaline pH and % activity in figure 3). Therefore, the enzymes of Yu are distinct from those of the presently claimed invention. For all of these reasons, applicant respectfully submits that Yu does not anticipate the claims as amended nor new claim 86.

Claims 37-40, 60-74, 77, 78, and 80-82 were rejected under 35 U.S.C.§ 102(e) as being anticipated by U.S. Patent No. 6,387,690 of Schulein *et al.* (hereinafter Schulein '690). The Official action stated Schulein '690 disclosed an endoglucanase composition isolated from *Phycomyces niteus*. The Official action admitted Schulein '690 does not disclose that the endoglucanase

belongs to family 45 or that it has an N-terminal CBD, but argued that the reference inherently discloses the same enzyme as is claimed and the burden is on the applicant to show a novel or unobvious difference between the claimed product and the product of the prior art.

Applicant respectfully disagrees for the following reasons. Schulein '690 relates to an endoglucanase preparation having conserved regions of the catalytic domain described in claim 1 and their use for industrial applications. Schulein '690 presumes a partial amino acid sequence near the catalytic domain derived by PCR (figure 3). Not enough information is given of the *Phycomyces nitens* sequence to conclude or presume that the CBD is located in the N-terminal region of the protein. In fact, it is likely to be located in the C-terminal region because enzymes with C-terminal region CBDs are described throughout Schulein '690 (for example, figure 1) and these are the basis for the PCR derived *P. nitens* sequence. Further, Schulein '690 does not detect cellulase activity from *Phycomyces nitens*. Thus, the grounds for identification of this enzyme as an endoglucanase of the present invention are lacking. Further, the partial amino acid sequence inferred from the results of PCR in Schulein '690 is different from the endoglucanase amino acid sequence from *P. nitens* of the present invention, with an identity of about 40%. Finally, Schulein '690 does not disclose the enzymes comprising the claimed SEQ ID NOs: 1, 3, 5, 7, 9, or 11 nor polynucleotides therefore. For all of these reasons,

applicant respectfully submits that the Schulein '690 reference does not anticipate, nor render obvious, the claims as amended or new claim 86.

Claims 60-71 and 74-85 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yu in view of Schulein '998 or Schulein '690. The Official action stated it would have been obvious to have used the method of Schulein for isolation of an endoglucanase and manipulation of polynucleotides encoding the same with the new enzyme taught by Yu. For the reasons given above, the new enzyme taught by Yu is distinct from those of the presently claimed invention, so that the combination of Schulein '998 or Schulein '690 with Yu also fails to render the instant invention obvious. Further, there is no motivation or suggestion in the prior art for one of ordinary skill in the art to have modified the Yu reference as suggested in the Office action. Schulein '998 and Schulein '690 are directed to different enzymes than Yu. Further, the Mucor sp. enzyme disclosed in Yu had very low activity. Yu is directed to use of a different enzyme from a different species as desirable. The ordinary artisan would not have chosen the Mucor sp. enzyme with very low activity for further manipulation as suggested in the Office action, because it had low activity in the teaching of Yu.

In summary, for the foregoing reasons the instant claims as amended and new claim 86 are not taught or made obvious by any combination of Schulein '998, Schulein '690 or Yu. Further, the claims as amended and new

claim 86 are fully described and enabled by the specification as originally presented. Therefore, applicant respectfully respects the withdrawal of all the rejections set forth in the outstanding Office action.

In light of the foregoing amendments and remarks, a formal allowance of claims 37-40 and 60-86, together with withdrawn claims 1-11, 13-36, 41-56, 58, and 59, is respectfully requested. While it is believed that all the claims in this application are in condition for allowance, should the examiner have any comments or questions, it is respectfully requested that the undersigned be telephoned at the below listed number to resolve any outstanding issues.

In the event this paper is not timely filed, applicant hereby petitions for an appropriate extension of time. The fee therefor, as well as any other fees which become due, may be charged to our deposit account No. 22-0256.

Respectfully submitted,
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